

# AN OPTICAL TECHNIQUE FOR REMOTE SENSING OF NEAR-SURFACE TURBULENCE

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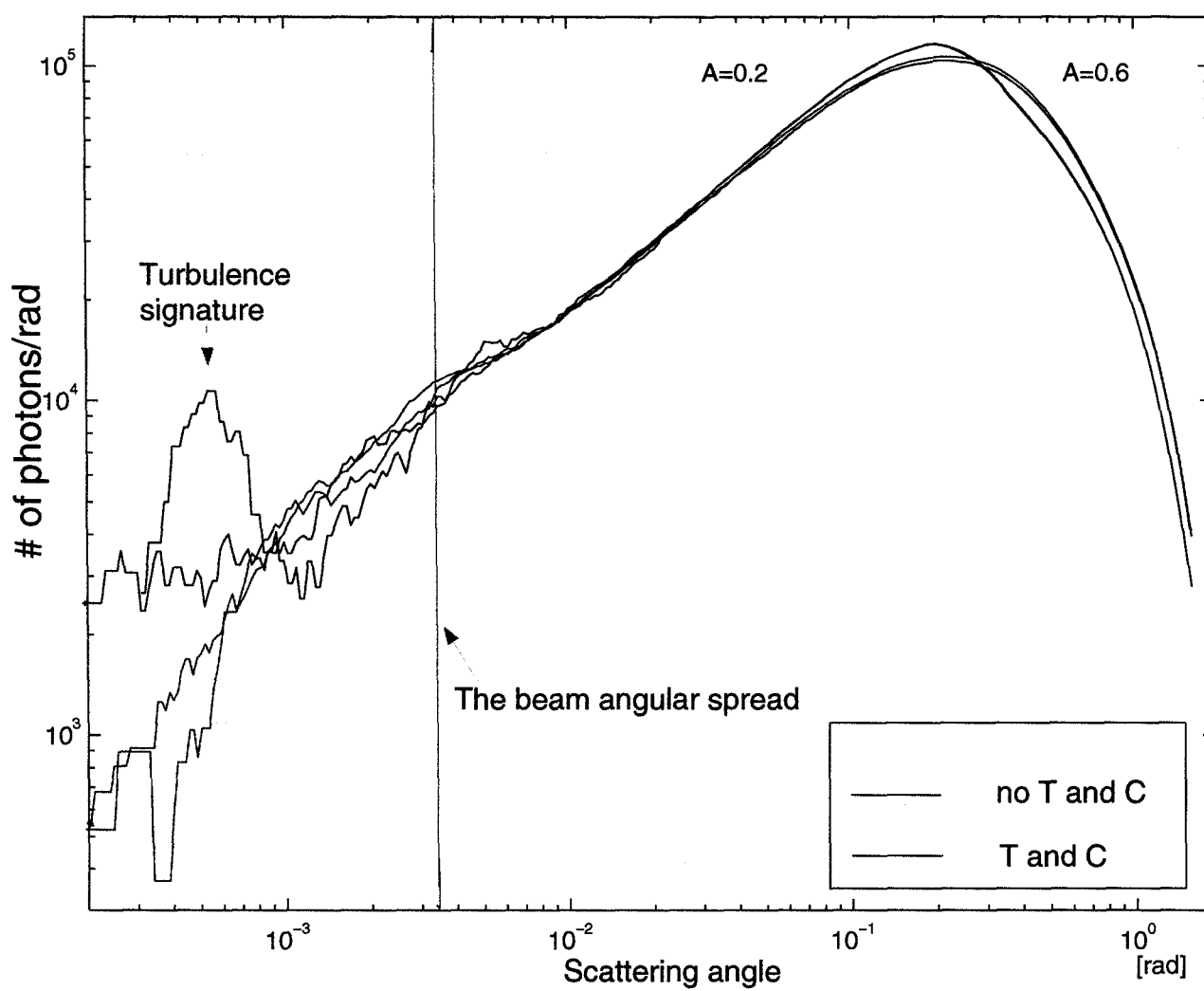
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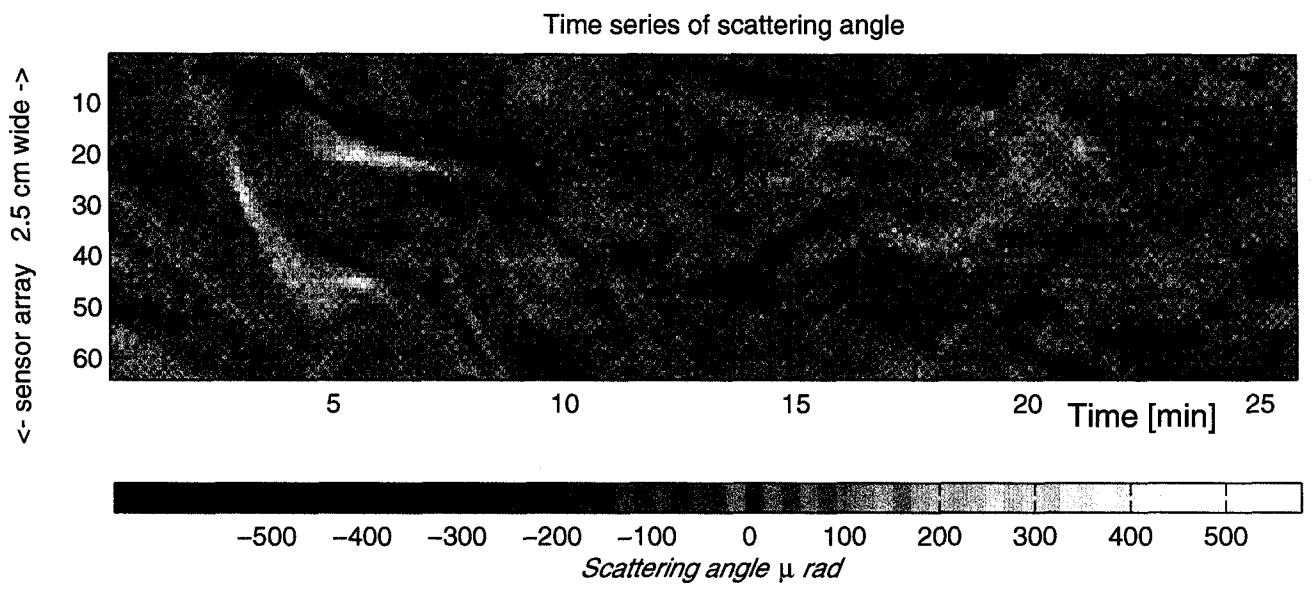
Measurements of turbulent kinetic energy dissipation rates (TKE) or temperature dissipation rates of the near-surface boundary layer are needed to understand air-sea exchange processes and rates. The capability to accurately estimate these variables by means of a remote technique is relevant to a number of questions ranging from the air-sea transfer of heat and gas to the fate of pollutants. The intermittent and variable nature of processes governing TKE or temperature dissipation require both high frequency and good spatial coverage of near-surface energetics. The large dynamic range of the active air-sea boundary presents difficulties to in situ measurement. We propose a non-invasive method based on optical remote sensing to quantify the energetics in the immediate vicinity of the air-sea boundary. Our optical method is based on the near-forward light scattering within a turbulent flow field. It permits the quantification of the energy and temperature dissipation rates. The Monte Carlo simulations of radiative transfer show that the method will be insensitive to the state of the ocean surface, that is it can perform well at low and high wind speeds.

# ROADMAP

- Introduction
  - optical oceanography
  - turbulence and microstructure
- Turbulence has optical signature
- Diffractive optics: potential oceanographic tool
- Experiment and simulations
- Conclusions We have investigated experimentally the small-angle scattering of a light beam in a turbulent flow and with particles. We also compared the near-forward scattering by typical oceanic particulate assemblages with turbulence-induced scattering, and found that turbulence dominates scattering up to 0.1 deg over pathlengths on the order of centimeters.

# Comparison between (C)apillary waves and (T)urbulence scattering





Our results confirm that the frequently observed in situ high values of the volume scattering function at small angles are related to scattering on turbulent inhomogeneities.